APPENDIX A-3

SALUDA HYDROELECTRIC PROJECT LOWER SALUDA RIVER BENTHIC MACROINVERTEBRATE MONITORING AND ENHANCEMENT PROGRAM

SOUTH CAROLINA ELECTRIC & GAS COMPANY

COLUMBIA, SOUTH CAROLINA

SALUDA HYDROELECTRIC PROJECT

(FERC NO. 516)

LOWER SALUDA RIVER BENTHIC MACROINVERTEBRATE MONITORING AND ENHANCEMENT PROGRAM

FINAL

JULY 2009

Prepared by:

Kleinschmidt

Energy & Water Resource Consultants

SOUTH CAROLINA ELECTRIC & GAS COMPANY
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
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1.0 INTRODUCTION

The Saluda Hydro Project (Project) is a 202.6 megawatt (MW) hydroelectric facility owned and operated by South Carolina Electric & Gas (SCE&G or Licensee) and located on the Saluda River in Lexington, Newberry, Richland, and Saluda counties of South Carolina (Figure 5-1). The Project is currently licensed by the Federal Energy Regulatory Commission (FERC No. 516), and the present license is due to expire in the year 2010. SCE&G has been engaged with state and federal agencies, non-governmental organizations (NGO's), and other stakeholders in a cooperative relicensing process for the Project since early 2005. The final application to relicense the Project was filed with the FERC on August 27, 2008.

During the relicensing process, a number of stakeholders, representing primarily state and federal resource agencies and non-governmental organizations, requested that SCE&G study the macroinvertebrate community of the lower Saluda River (LSR) to evaluate the effectiveness of recent dissolved oxygen (DO) enhancements at the Project (i.e. turbine venting). SCE&G subsequently formed a Freshwater Mussels and Benthic Macroinvertebrate Technical Working Committee (TWC) to address issues related to these species, which included representatives from the U.S. Fish and Wildlife Service (USFWS), NOAA – National Marine Fisheries Service (NMFS), South Carolina Department of Natural Resources (SCDNR), South Carolina Department of Health and Environmental Control (SCDHEC), and American Rivers. With oversight from the TWC, a two-year relicensing study of the LSR macroinvertebrate community was developed and implemented during 2006 and 2007. As is typical of hydropower projects, the study found generally impaired conditions close to the dam, with conditions improving with increased downstream distance from the dam (additional detail provided below in Background Information). In comments issued on the Draft License Application for Saluda Hydro, state and federal resource agency staff requested that SCE&G develop a plan for mitigation and/or continued monitoring of the LSR macroinvertebrate

community under a new license term. The program described herein was prepared pursuant to their request.

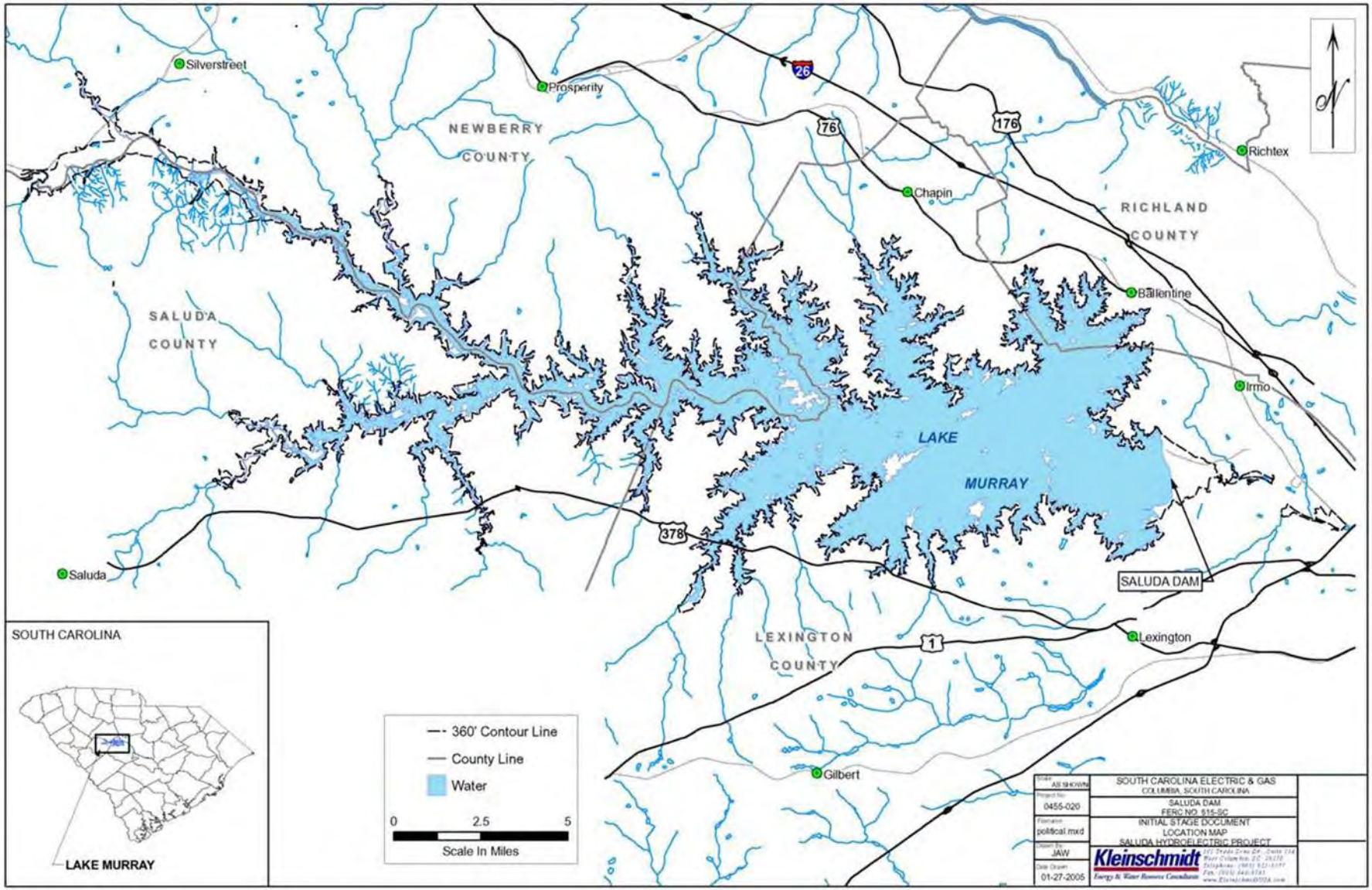

Figure 5-1: Location Map for the Saluda Hydroelectric Project (FERC No. 516)

2.0 BACKGROUND

The benthic macroinvertebrate community of the LSR downstream of Saluda Hydro has been assessed regularly by SCE&G over the past decade (Shealy, 1996a; 1996b; 2001; 2004; 2005; Carnagey Biological, 2006; 2007). Recent assessments have shown that biotic conditions (based on metrics such as taxa richness and abundance, EPT Index, EPT abundance, and dominant taxa) improved with increased distance from the Project dam (Shealy, 2004; 2005; Carnagey Biological, 2006; 2007). Similarly, North Carolina Biotic Index (NCBI) scores from these studies have generally ranged from "good" to "fair" for lower sites near the Riverbanks Zoo, to "poor" at sites directly below the dam (Shealy, 2004; 2005; Carnagey Biological, 2006).

The most recent assessment (Carnagey Biological, 2006; 2007), conducted in 2006 and 2007 as part of the current relicensing, sampled the LSR macroinvertebrate community at six locations downstream of Saluda Hydro. This study was conducted during the late-summer and early-fall months when DO levels were expected to be at their lowest levels and employed both the artificial substrate samplers used in previous assessments (Hester-Dendy multi-plate), as well as rapid bioassessment methods (Barbour et. al., 1999). As in previous studies, regression analysis of the Hester-Dendy data suggested improved biotic conditions as distance from the Saluda Hydro dam increased during both 2006 and 2007. NCBI scores during the study generally ranged from "poor" immediately downstream of Project dam (TR) to "fair" to "good-fair" at the Oh Brother Rapids (OB) downstream near the Interstate 26 crossing. These results were not surprising, as studies have shown that operation of hydroelectric dams often results in decreased benthic diversity immediately downstream due to habitat instability associated with water level fluctuations and scour associated with increased water velocity (Carnagey Biological, 2006; 2007).

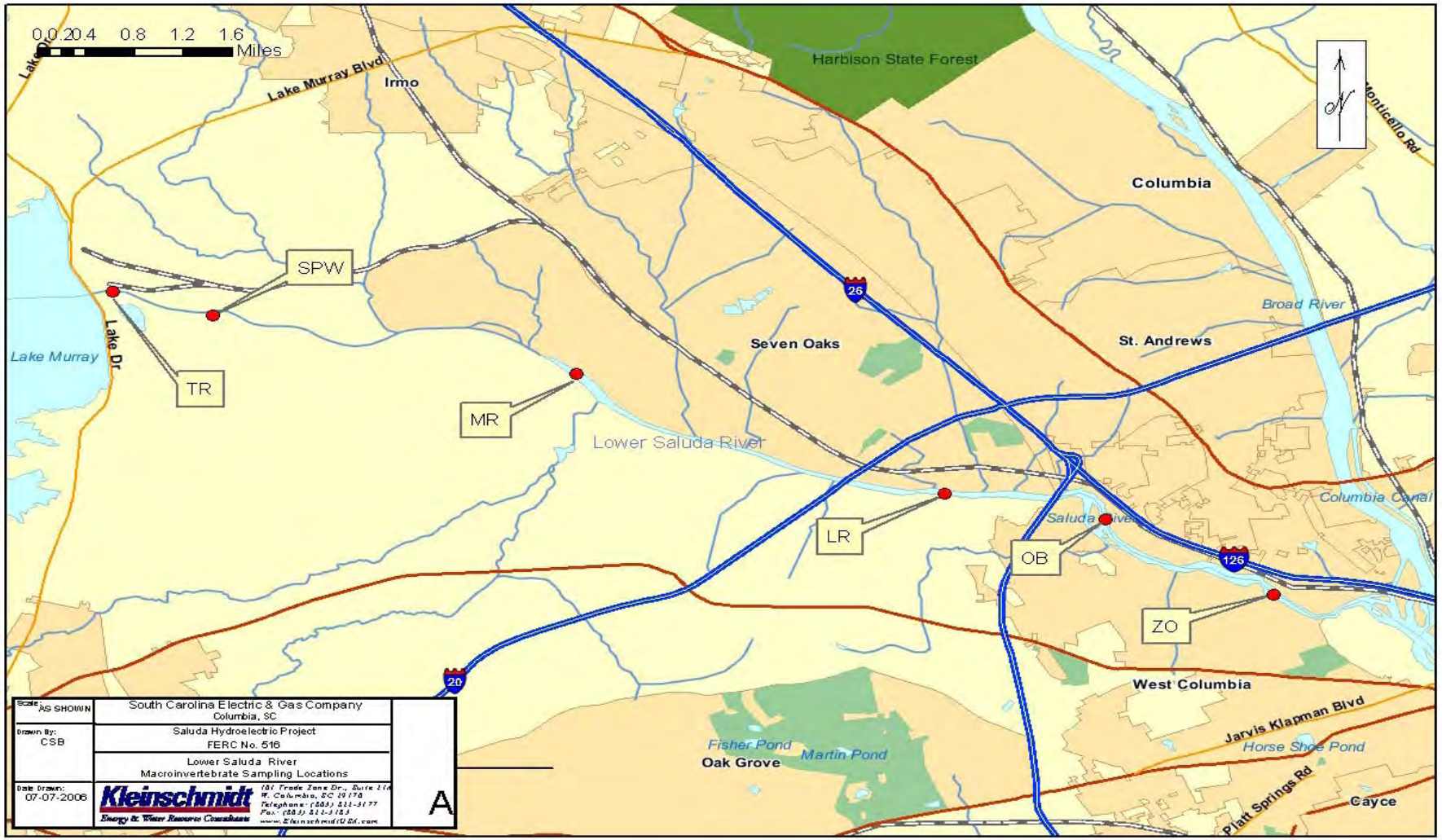

Figure 0-1: Locations Sampled During 2006/2007 Lower Saluda River Macroinvertebrate Relicensing Study

3.0 ENHANCEMENT AND MONITORING

SCE&G proposed in its Final License Application for Saluda Hydro (filed with the FERC on August 27, 2008) to continue turbine aeration measures implemented since 1999 aimed at optimizing DO in Project releases. Specifically, these measures included installation of turbine venting and hub baffles on Project turbines (completed in 1999 and 2005, respectively), as well as implementation of operational modifications ("look-up tables") developed in recent years to provide guidance regarding unit and gate combinations that provide the greatest DO enhancement under various operating scenarios. These measures have resulted in significant DO improvements in the LSR, with median DO in Project releases increasing from 2.7 mg/L before 1999 to 7.2 mg/L after implementation (1999 to 2007). Likewise, this has resulted in less frequent occurrences of DO levels in the release below 5.0 mg/L, from 88% to about 12% of the time.

SCE&G has also proposed to implement minimum flow releases from Saluda Hydro to support target riverine species in the LSR, including benthic macroinvertebrates. In addition to improved DO conditions (through increased shoaling and turbulence), implementation of minimum flows will likely improve benthic macroinvertebrate habitat by ensuring more stable flows and maintenance of riverine wetted width. Physical Habitat Simulation (PHABSIM) modeling conducted in support of the current relicensing suggests that the 700 cfs minimum flow being proposed for the majority of months during a normal water year will provide between 71% and 97% of maximum Weighted Usable Area (an estimate of available habitat) for benthic macroinvertebrates, depending on the river reach being considered (Kleinschmidt 2008).

During the period of the new Project license, SCE&G plans to install new turbine runners of modern design that offer higher efficiencies, output, and dissolved oxygen (DO) uptake. The schedule for turbine runner upgrades will be determined based on an adaptive approach intended to allow for a full evaluation of the levels to which downstream water quality goals are achieved. Under the proposed schedule, Unit 5 will be upgraded within three years of issuance of the new license. If subsequent water quality evaluations determine that SCDHEC site-specific DO standard is still not being consistently met, an additional unit (preferably Unit 3) will be upgraded within two years of completion of the Unit 5 upgrade. This cycle will be repeated until the SCHEC site-specific DO standard is attained. Should upgrade of Unit 5 prove sufficient for meeting the standard, the remaining units will be upgraded according to the following schedule: Unit 3 – within five years of license issuance; two units (preferably Units 4 and 1) - within 15 years of license issuance; and the last unit (preferably Unit 2) – within 25 years after

license issuance. Additional detail regarding the schedule for turbine runner upgrades is provided by the CRSA.

Because continuation of DO enhancement measures, turbine runner upgrades and implementation of minimum flows are likely to improve the aquatic habitats of the LSR, and because macroinvertebrates serve as an important bioindicator of aquatic health, state and federal agencies deemed it necessary to implement a long-term aquatic macroinvertebrate monitoring program. Details regarding timing, duration, methodology, and reporting/consultation requirements of the program are provided below.

3.1 Monitoring Program

Under a new FERC License for the Saluda Project, the macroinvertebrate fauna of the LSR will be sampled for a period of two consecutive years following completion of each turbine runner upgrade (See Section 0). Sampling will occur at four locations in the LSR's mainstem: (1) the first cobble/gravel riffle downstream of the Project – Toenail Riffle (TN); (2) adjacent to Corley Island (CI); (3) the Ocean Boulevard shoal area (OB); and (4) adjacent to Riverbanks Zoo (ZO)[3] (Figure 3-2). Two of these sites (OB & ZO) are consistent with previous investigations on the LSR[4]. Although not previously sampled, the Corley Island (CI) area represents a significant aquatic habitat in the LSR, with extensive gravel substrates and shoal/riffle habitats, and thus has been added to this monitoring program. The Toenail Riffle Area (TN) has likewise not been previously sampled, but represents the closest riffle area to the dam (0.7 mi).

Monitoring will be conducted bi-annually at each of the sample sites during each year of the two-year monitoring periods. Bi-annual sampling will consist of a spring sample coinciding with the period when DO levels are typically highest downstream of Project (March – April), as well as a late-Summer and early-Fall months (August – October) when downstream DO conditions are typically at their most critical.

[3] Site is in close proximity to the "old police club" (OPC) sampled in previous investigations (see Shealy 2005); sites may be used interchangeably depending on field conditions and access.
[4] Habitat is described in previous investigations at these sites (Shealy 2001; 2003; 2004; 2005).

Bi-annual sampling will employ both the artificial substrate (Hester-Dendy) and multi-habitat sampling methods utilized in previous LSR studies. Multi-habitat sampling will follow the USEPA *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (Barbour et al., 1999) and will involve timed, quantitative sampling of the various habitat types available within the identified reaches (i.e. cobble, sand, snags, woody debris, etc.) using kicknets and/or D-shaped dipnets. To the extent possible, each habitat type will be sampled in approximate proportion to its availability. Artificial substrate sampling will employ three replicate Hester-Dendy multi-plate samplers, which will be allowed to colonize at each location for 45–60 days.

Intact Hester Dendy samplers, as well as raw samples from the multihabitat assessment, will be preserved in the field with 95% ethanol and transported to a South Carolina Department of Health and Environmental Control (SCDHEC) – approved laboratory for processing. In the laboratory, macroinvertebrates will be separated from debris with the aid of a stereo microscope, identified to the lowest possible taxonomic level, and enumerated using appropriate techniques and taxonomic keys. Specimens will be maintained in a voucher collection for five years or placed permanently in a reference collection.

Differences in taxonomic composition between sampling sites will be examined using appropriate bioassessment metrics, as described in Barbour et al. (1999). These metrics will likely included taxa richness (diversity); EPT (Ephemeroptera, Plecoptera, Trichoptera) Index; Chironomidae taxa and abundance; ratio of EPT and Chironomid abundance; ratio of scraper/scraper and filtering collectors; shredder/total number of specimens collected; percent contribution of dominant taxa; and North Carolina Biotic Index (NCBI)[5]. Regression analyses may also be used to detect trends in community composition as a function of distance from the dam. Water Quality data (dissolved oxygen and temperature) will also be reported for the sampling period. Water quality data will be obtained either from the two USGS gages on the LSR (#02168504, Saluda River below Lake Murray Dam or #02169000, Saluda River near Columbia) or from field measurements collected during macroinvertebrate sampling.

[5] Bioassessment metrics are described in greater detail in Barbour et al. (1999) and in reports summarizing previous macroinvertebrate investigations at the LSR sites (Shealy 2001; 2003; 2004; 2005).

3.1.1 Schedule

The macroinvertebrate community of the LSR will be monitored for a period of two years following completion of each of the turbine runner upgrades outlined in Section 0, until such time that water quality evaluations suggest that the LSR site-specific DO standard is being attained. Once the water quality standard is attained, macroinvertebrate fauna will be monitored for one additional two-year cycle. A timeline of a scenario assuming that upgrade of four turbines would be needed in order for the water quality standard to be attained is presented in Table 0-1.

Each two-year monitoring period will commence at least one year, but not more than two years following completion of the associated turbine upgrade. This minimum one-year period will allow for attenuation of the biotic community prior to commencement of the sampling period.

In the event that the initial turbine upgrade (Unit 5) results in attainment of the site-specific DO standard, the macroinvertebrate fauna will be monitored for a period of four consecutive years following completion of the one year attenuation period.

3.1.2 Reporting and Consultation

Results of each two-year macroinvertebrate monitoring period will be summarized in a draft report, which will be issued to state and federal resource agencies and other interested parties on or before January 31 of the year following completion of the sampling period.

SCE&G will consult with state and federal resource agency staff prior to implementing each two-year monitoring period, annually during the two-year monitoring period and a minimum of once following completion of each two-year period to review the draft report. As such time that post-upgrade water quality assessments suggest that the site-specific DO standard for the LSR is being attained, SCE&G will initiate consultation with state and federal agencies to review macroinvertebrate monitoring to date and asses the need for additional monitoring and/or mitigative measures relative to macroinvertebrate fauna. Such

consultation may be combined with other resource agency consultation relative to water quality; fisheries; freshwater mussels; rare, threatened and endangered species; or other Saluda Hydro enhancement/monitoring programs.

Timing, duration, methodology or other aspects of this program may be modified based on agency consultation.

Table 0-1: Example Macroinvertebrate Sampling Timeline—Assumes Four Turbine Upgrades are Needed to Meet the Lower Saluda River Site-Specific Dissolved Oxygen Standard

YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Unit	New License												
Unit 5				Upgrade	Wait	Sample							
Unit 3						Upgrade	Wait	Sample					
Unit 4								Upgrade	Wait	Sample			
Unit 1										Upgrade	Wait	Sample	

*This schedule assumes that only 4 units would need upgrades (Units 1, 3, 4, 5)

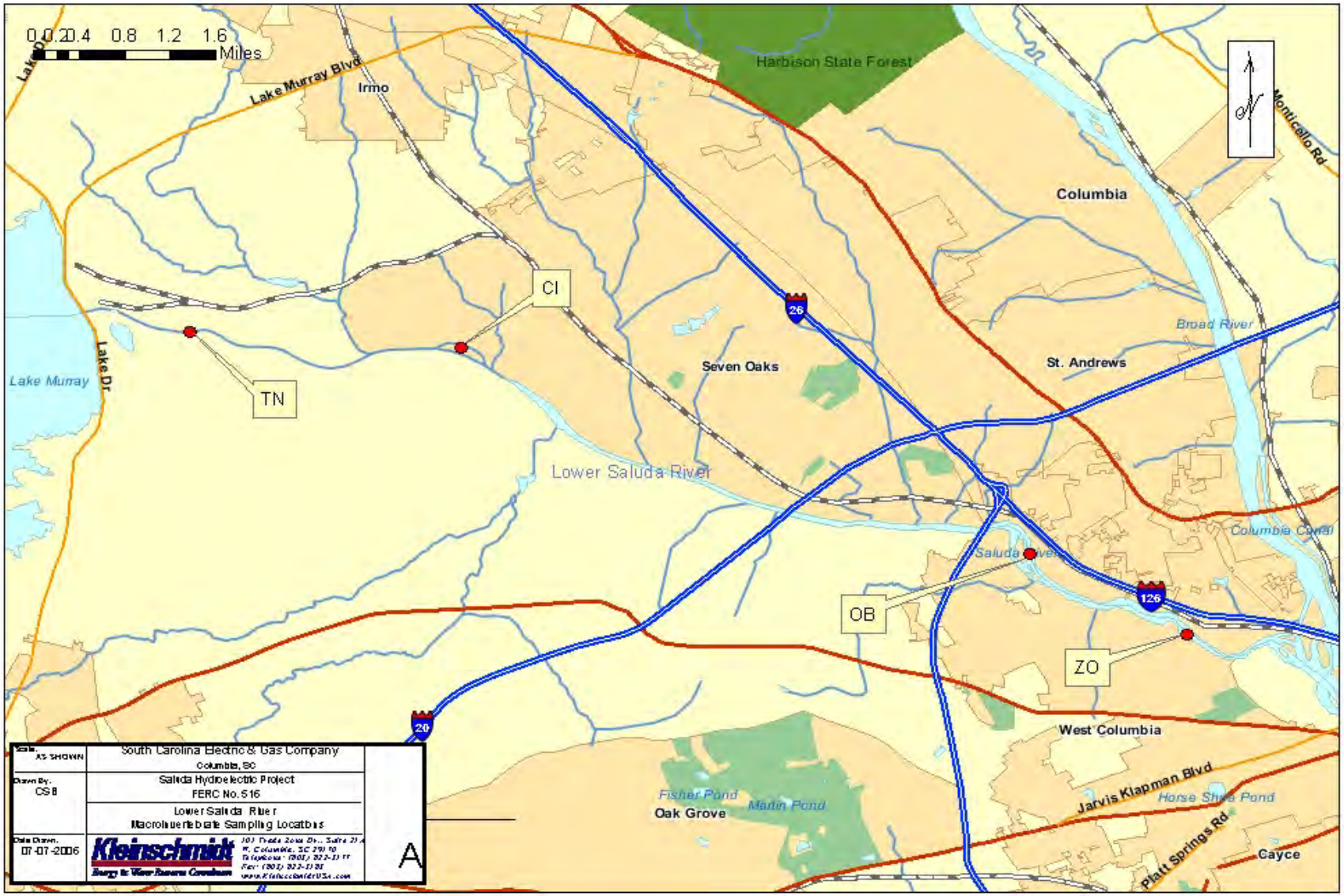

Figure 3-2: Proposed Macroinvertebrate Sampling Locations in the Lower Saluda River Downstream of the Saluda Hydroelectric Project Dam

4.0 LITERATURE CITED

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